Assessment of building damage induced by excavation using plate analogy

Abstract

Prediction of building tolerance to excavation-induced ground displacements is a major concern in underground construction in urban areas. Currently the limiting tensile strain procedure is the most commonly used method for predicting building damage. In this method, it is assumed that the onset of cracking is associated with the average tensile strain within the structure. Linear-elastic deep beams are used to simulate individual walls of the building. Due to the two-dimensional nature of the method, the walls are taken to be perpendicular to the excavation axis and the effects of warping and twisting of the building are ignored. In this paper, the whole building is assumed to behave like a simply supported rectangular elastic plate which is uniformly loaded. The third-order plate theory of Levinson is used to obtain the deflection of the plate in terms of bending and diagonal strains. By simple superposition, the effect of twist and horizontal displacement on the tensile strain in the building is included. The exact elasticity solution for homogenous plate subjected to tensional loading is used to obtain the tensile strain in the twisted plate.